SBIG®
IMAGING SYSTEMS
A Division of Diffraction Limited

STX Guider User's Manual

Version 1.0 - June, 2016

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the receiver and the equipment.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- Use shielded I/O cables when operating this equipment.
- You are also warned that any changes to this certified device will void your legal right to operate it.

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The SBIG STX Guider

Introduction

Self-guiding has long been acknowledged as the best, most accurate way to guide long exposure astrophotos, particularly with commercial SCTs. The single most common complaint however, is finding bright stars when guiding through dark or narrowband filters.

The SBIG STX Guider incorporates a KAI-0340 CCD chip with a 640 x 480 pixel array and 7.4 micron pixels. The unit attaches to the front of the STX filter wheel so that it receives light from the guide stars before that light passes through any filters. In addition, the optical elements that transfer the light from the pick-off mirror to the guiding CCD act as a 0.7X focal reducer. The result is a doubling of the field of view for the CCD, with a correspondingly greater selection of guide stars. The STX Guider's CCD chip is the same sensor used in the Remote Guide Head.

There are two adjustment knobs on the STX Guider, one for focus and one for moving the pick-off mirror to avoid vignetting. A third knob on the side of the unit locks the adjustments in place once the best guider focus is achieved. A short HDMI cable is provided to connect the STX Guider to the remote guide head port on the camera. Four 6-32 x 1 3/8" SHCS mounting screws are also provided to attach the STX Guider to the filter wheel.

The STX Guider is fully compatible with the AO-X Adaptive Optics unit and works with either the FW5-STX or FW7-STX Filter Wheel.

The STX Guider requires only 1.1" of back focus, and no additional adapters are needed for installation. The unit weighs only 1 pound.

Pre-installation steps

1. Remove the STX Guider and other components from their packaging. Retain the packaging materials for future use, if ever required.

   CAUTION:

   Do not touch the connectors, wires, or circuit board visible on the exposed face of the guider unit. Components on the circuit board can be damaged by electro-static discharge.

2. Place your camera and filter wheel assembly on a clean firm flat surface, with the telescope opening facing upwards.

3. Have the required 7/64-inch hex key wrench available.

4. Perform either installation procedure A or B, as applicable to your configuration.

A. Installing the STX Guider without an AO-X Adaptive Optics unit

This procedure presumes that you have an FW5-STX or FW7-STX Filter Wheel and accessory mounting ring plate currently installed on your STX or STXL camera.

1. Ensure that the power into the camera is turned OFF.

   CAUTION:

   Always disconnect power before connecting or disconnecting cables.

2. Remove the four 6-32 x 3/16 inch (5 mm) screws that fasten the accessory mounting ring plate to the front of the filter wheel.

   NOTE:
   Be aware of the location of any leveling shims used around the screws that hold the accessory mounting ring plate to the filter wheel. These shims must later be replaced in exactly the same orientation with respect to the camera as they were installed (your camera was also supplied with a sheet indicating the proper shim positions). The shims are in place to provide a flat mounting surface to the telescope that is completely parallel to the camera's CCD chip.

3. Place the STX Guider onto the filter wheel, with the exposed face of the guider toward the filter wheel. Align the four screw holes of the guider with those on the filter wheel. Note the orientation of the STX Guider and filter wheel.

4. Hold the accessory mounting ring plate over the STX Guider and align the four screw holes with those on the filter wheel.

5. Insert the four supplied 6-32 x 1-3/8 inch (35 mm) hex screws in through the top of the accessory mounting ring plate. Replace any leveling shims you removed onto the screw shafts before you thread the screws into the filter wheel. The shims must be mounted between the accessory plate and the STX Guider. They must be re-installed in the same orientation with respect to the camera as they were prior to the removal of the accessory plate. The installed 3" accessory ring plate included with your STX or STXL camera is shown here.

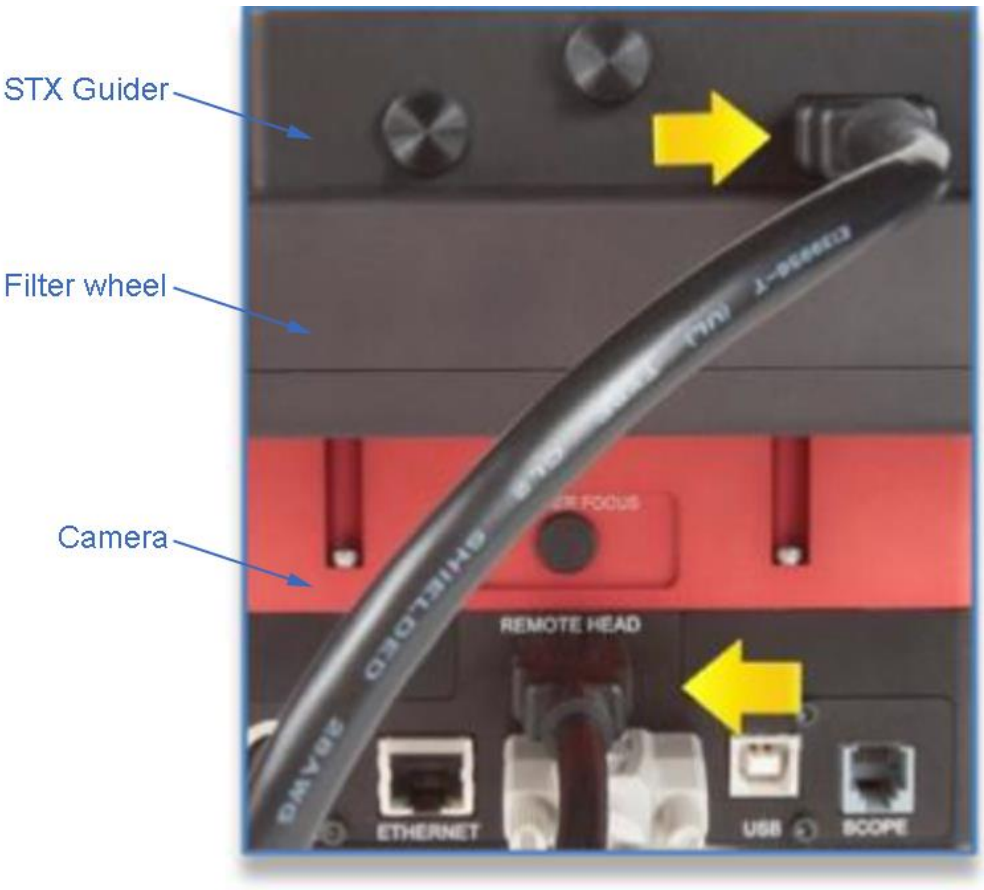
Thread and tighten the screws into the filter wheel.

6. Attach your telescope coupling to the accessory mounting ring plate.

7. Connect the supplied HDMI cable between the STX Guider and the REMOTE HEAD port of your camera.

CAUTION:

Never "hot plug" the HDMI cable plug into or from the remote guide port on the camera as this may damage the port. Always turn the power turned OFF before connecting or disconnecting the HDMI cable.



8. Install the completed equipment assembly onto the telescope.

9. Turn the camera's power ON.

10. The STX Guider is now ready to be adjusted.

    Refer to the ***Setting up the STX Guider*** section.

B. Installing the STX Guider with an AO-X Adaptive Optics unit

This procedure presumes that you have an FW5-STX or FW7-STX Filter Wheel and an AO-X Adaptive Optics unit with an accessory mounting ring plate currently installed on your STX or STXL camera.

1. Ensure that the power into the camera is turned OFF.

   CAUTION:
   Always disconnect power before connecting or disconnecting cables.

2. You must remove the adaptive optics unit from the filter wheel, since the STX Guider must be installed between the filter wheel and the AO-X.

3. Disconnect the AO-X cable from the I^2C AUX port on the camera.

4. Remove the four 6-32 x 3/16 inch (5 mm) hex screws that fasten the accessory mounting ring plate to the front of the AO-X Adaptive Optics unit.

   NOTE:
   Be aware of the location of any leveling shims used around the screws that hold the accessory mounting ring plate to the adaptive optics unit. These shims must later be replaced in exactly the same orientation with respect to the camera as they were installed (your camera was also supplied with a sheet indicating the proper shim positions). The shims are in place to provide a flat mounting surface to the telescope that is completely parallel to the camera's CCD chip.

5. On the front (telescope side) of the AO-X, there are four screws that hold the unit together. Remove the screws, and lift off both the front plate and the body of the AO-X, and place them aside on a clean, flat surface.

6. Remove the four 6-32 x 3/16 inch (5 mm) hex screws that attach the AO-X rear plate to the filter wheel. Lift the rear plate off the filter wheel and place it aside on a clean, flat surface.

7. Place the STX Guider onto the filter wheel as shown on the following page, with the exposed face of the guider toward the filter wheel. Align the four screw holes of the guider with those on the filter wheel. Note the orientation of the STX Guider and filter wheel.

8. Place the AO-X rear plate on top of the STX Guider and align the four mounting holes.

9. Fasten the AO-X rear plate and the STX Guider to the filter wheel using the four supplied 6-32 x 1-3/8 inch (35 mm) hex screws.

10. Place the AO-X body and front plate onto the rear plate and fasten them using the four screws removed in step 5.

11. Hold the accessory mounting ring plate over the AO-X unit and align the four mounting holes of the units.

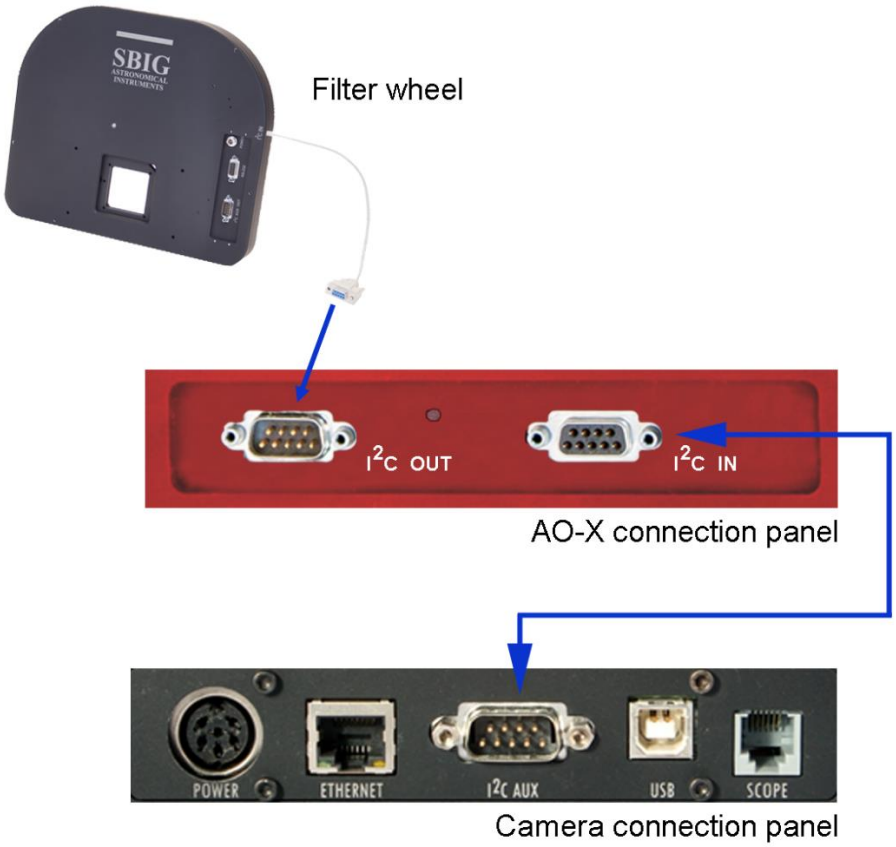
12. Insert the four 6-32 x 3/16 inch (5 mm) hex screws in through the top of the accessory mounting ring plate. Replace any shims you removed onto the screw shafts before you thread the screws into the AO-X. The shims must be re-installed in the same orientation with respect to the camera as they were prior to the removal of the accessory mounting ring plate. Thread and tighten the screws into the AO-X unit.

13. Attach your telescope coupling to the accessory mounting ring plate.

14. Reconnect the hard-wired cable from the filter wheel to the I²C OUT port on the AO-X. Then reconnect the cable between the I²C IN port on the AO-X and the I²C AUX port on the camera, as shown below.

CAUTION:

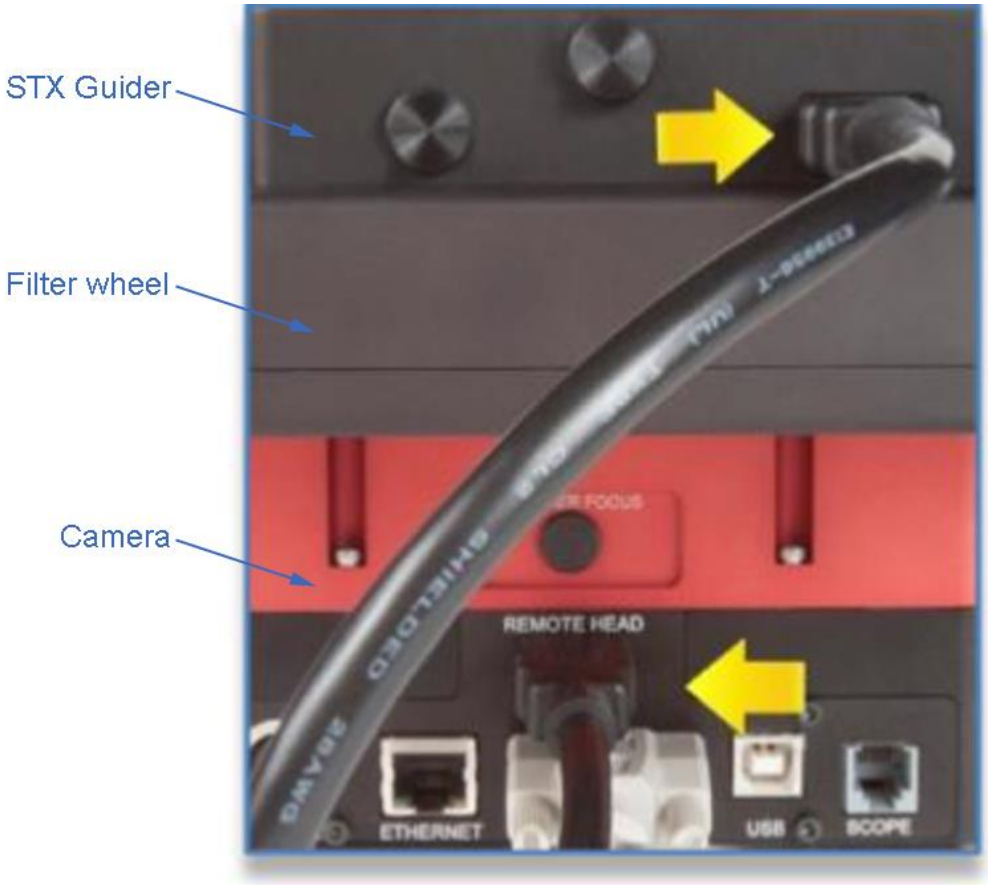
Never "hot plug" the I²C cables into or from the units. Always disconnect power before connecting or disconnecting cables.



15. Connect the supplied HDMI cable between the STX Guider and the REMOTE HEAD port of your camera, as shown below.

CAUTION:

Never "hot plug" the HDMI cable plug into or from the remote guide port on the camera as this may damage the port. Always disconnect power before connecting or disconnecting cables.



16. Install the completed equipment assembly onto the telescope.
17. Turn the camera's power ON.
18. The STX Guider is now ready to be adjusted.

    Refer to the ***Setting up the STX Guider*** section.

Setting up the STX Guider

1. Power up your camera assembly. The STX Guider derives its power from the cable connection to the REMOTE HEAD port on the camera.

2. Establish connections to the various components using MaxIm DL, CCDOPS, or other applicable software.

3. Loosen the LOCK knob on the side of the guider assembly so that the slides are free to move (about one turn).

4. Locate the two adjustment knobs on the STX Guider used to set the placement of the pick-off mirror in the telescope's light path and to focus a guide star on the guider's CCD chip.

5. Start with the PICK-OFF MIRROR knob turned fully counter-clockwise. This extends the mirror to its maximum travel (the screw is captive and so will not disengage). For most optical systems this will provide an unvignetted view on the STX or STXL camera. However, for very fast optical systems there is a possibility of vignetting. Check for this as follows:

    a) Point the telescope at a nearby wall or flat field screen illuminated by ambient light or artificial light of some kind. Total darkness is not necessary.

    b) Start up the camera's imaging CCD in focus mode, with an exposure adequate to get a uniform but not saturated field. A count level of 5,000 to 50,000 should be fine. The CCD does not need to be focused on a star field first.

c) If you see a shadow on one side of the camera's image, this is the shadow of the guider mirror vignetting the camera's CCD. This is undesirable, and so requires adjustment.

While watching the camera's image updating on the computer screen, rotate the PICKOFF MIRROR knob clockwise. This will pull the mirror back from the optical axis. This adjustment varies with the telescope design and focal ratio, which is why it cannot be pre-set at the factory. At the same time, it is important to get the mirror as far into the field of view as possible without vignetting the main imager.

✦ ***TIP:***
Once the PICK-OFF MIRROR knob has been properly positioned, it should only require re-adjustment if you mount your camera assembly on another telescope or otherwise change your optical configuration. We recommend putting some tape over it so you don't accidentally use the wrong knob in the dark and change that adjustment – it's easy to do!

6. Point the telescope at a star-rich region in the night sky, select the filter you want to use, and focus the camera's CCD using the telescope focuser controls.

7. Start the STX Guider in focus mode with an exposure of 1 to 3 seconds.

8. Focus the guider's image by turning the CCD FOCUS knob on the assembly until good focus is achieved. Finding guide stars initially can sometimes be a bit difficult, so target an open cluster or other star-rich area of the sky to facilitate this.

9. Once you see stars, focusing on them is easy due to the action of the built-in focal reducer. A critical focus is not required for the guider. However, if you change filter thicknesses over the imaging CCD, the guider focus may need to be re-adjusted, but with reasonably matched filters this is usually not necessary.

✦ ***TIP:***
It is sometimes beneficial to slightly defocus a guide star image when guiding. This may allow the system to perform more consistent centroid calculations.

You may see a gradient in the guider image's sky background. This is due to the various apertures upstream from the guider assembly limiting its field of view, but this does not affect guiding. It merely causes stars that are farther off-axis to be dimmer.

NOTE:
The guider's focus position is affected by its mirror position. If necessary, you can increase the amount back focus for the guider by rotating the PICKOFF MIRROR knob clockwise. Try this in small steps.

10. Once the guider has been focused, rotate the LOCK knob clockwise to lock the positions of both adjustment knobs. This does not usually affect the guider's focus. If it does, you may need to repeat the focusing of the guider's CCD. Do not over-tighten the LOCK knob - just a snug fit is required.

    NOTE:
    The star images on the guider's CCD may not be as good as those on your main imaging CCD since the focal reducer reduces the focal ratio by 0.7X, and your guider is imaging considerably off-axis. This is not a problem for proper guiding.

11. You are now ready for guided imaging with your STX Guider and imaging system. Initiate the standard guider calibration procedure in your software. If you are using an AO-X Adaptive Optics unit, this should be turned on during the STX Guider's calibration procedure.

Maintenance

The STX Guider requires minimal maintenance. Use cotton swabs and isopropyl (rubbing) alcohol to clean the mirror if it becomes necessary. Never re-use a cotton swab - use only fresh ones. Apply only gentle pressure with the cotton swab during cleaning.

Specifications

Dimensions:	8.7 x 4.5 x 1.1 inches (221 X 114 x 28 mm)
Weight:	1 pound (455 gm)
Optical back focus:	1.1 inch (27.9 mm)